

the locomotive in the lead in the direction of travel of the locomotive, said apparatus comprising:

at least two phase-locking satellite receivers configured to reference signals received from a set of satellites; and

a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive.

REMARKS

The Office Action mailed January 2, 2002 has been carefully reviewed and the foregoing amendment has been made in consequence thereof. Submitted herewith is a Submission of Marked Up Claims.

Claims 1-31 are now pending in this application. Claims 1-31 stand rejected.

Applicants note the objections to the drawings. Submitted herewith are formal drawing sheets 1-4. No new matter has been added. For the reasons set forth above, Applicants respectfully request that the objections to the drawings be withdrawn.

The rejection of Claims 1-3, 15-17, 30, and 31 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,005,514 (Lightsey) is respectfully traversed.

Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination using GPS carrier phase measurements from nonaligned antennas. The method includes determining S10 the configuration of GPS patch antennas 10 on a vehicle 52, that includes master and slave antennas. Antenna reference frames are then measured S12 and carrier signals are received S14 by each antenna. For each set of carrier signals, a corrected, differential carrier phase is then determined S14. The corrected differential carrier phase measurements, along with other necessary inputs, are then used with conventional methods to determine an attitude of vehicle 52. The other necessary inputs may include the position of vehicle 52, GPS almanac information, and receiver to GPS line of sight information. In contrast to the present invention, Lightsey does not describe nor suggest determining an accurate heading of the vehicle.

Claim 1 recites a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises “determining an accurate heading of the locomotive...wherein the heading represents the direction of travel of the locomotive.”

Lightsey does not describe nor suggest a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method includes determining an accurate heading of the locomotive and the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Applicants respectfully submit that determining a vehicle roll, pitch, and azimuth attitude is not necessarily indicative of the heading, or direction of travel, of the vehicle, but is rather only a means of determining an orientation of the vehicle. For at least the reasons set forth above, Claim 1 is submitted to be patentable over Lightsey.

Claims 2, 3, and 30 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 2, 3, and 30 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 2, 3 and 30 likewise are patentable over Lightsey.

Claim 15 recites an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises “a processor configured to determine...an accurate heading of the locomotive...wherein the heading represents the direction of travel of the locomotive.”

Lightsey does not describe nor suggest an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus includes a processor configured to determine an accurate heading of the locomotive and the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Applicants respectfully submit that determining a

vehicle roll, pitch, and azimuth attitude is not necessarily indicative of the heading, or direction of travel, of the vehicle, but is rather only a means of determining an orientation of the vehicle. For at least the reasons set forth above, Claim 15 is submitted to be patentable over Lightsey.

Claims 16, 17, and 31 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 16, 17, and 31 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 16, 17, and 31 likewise are patentable over Lightsey.

For the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-3, 15-17, 30, and 31 be withdrawn.

The rejection of Claims 4 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Lightsey in view of U.S. Patent No. 4,999,782 (BeVan) is respectfully traversed.

Lightsey is described above. BeVan describes an apparatus for an aircraft area navigation system that provides transitioning from an inbound course 12 to an outbound course 14 of a lateral navigation waypoint. The apparatus determines, in conjunction with the aircraft altitude and angle of the course change, a maximum distance that the aircraft will deviate from either inbound course 12 or outbound course 14. The maximum distance is used in conjunction with the course change angle to generate a turn radius for a fixed curved transition path to be followed by the aircraft. The turn radius information together with the aircraft ground speed information, determined using aircraft heading from a conventional compass system 29 and true airspeed from a conventional air data system 28, is used to generate a bank angle bias command signal. The bank angle bias command is calculated to vary the bank angle of the aircraft to keep the aircraft on the fixed curved path throughout the transition from outbound course 14 to inbound course 12.

Applicants respectfully submit that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Lightsey nor BeVan, considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Lightsey with BeVan,

because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicants' own teaching. Rather, only the conclusory statement that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the equations of heading and heading rate in the claims in the invention of Lightsey because they are the known equations of vector math" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Applicants respectfully submit however, that a closer examination of the prior art would reveal that the prior art teaches away from the present invention. More specifically, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination using GPS carrier phase measurements from nonaligned antennas, and BeVan describes determining aircraft heading from a conventional compass system.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Since there is no teaching nor suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present

invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection be withdrawn.

Further, and to the extent understood, neither Lightsey nor BeVan, considered alone or in combination, describe or suggest the claimed combination, and as such, the presently pending claims are patentably distinguishable from the cited combination. More specifically, Claim 4 depends indirectly from independent Claim 1, which recites a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises “providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive...determining a set of phase differences between satellite reference signals received by satellite receivers...determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive.”

Neither Lightsey nor BeVan, considered alone or in combination, describe nor suggest a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method includes providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive, determining a set of phase differences between satellite reference signals received by satellite receivers, and determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Specifically, neither Lightsey nor BeVan, considered alone or in combination, describe nor suggest determining an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, BeVan describes determining aircraft heading from a conventional compass system. For at least the reasons set forth above, Claim 1 is submitted to be patentable over Lightsey.

Claim 4 depends indirectly from independent Claim 1. When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, Applicants submit that Claim 4 likewise is patentable over Lightsey in view of BeVan.

Claim 18 depends indirectly from independent Claim 15, which recites an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises “at least two phase-locking satellite receivers configured to reference signals received from a set of satellites...a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive.”

Neither Lightsey nor BeVan, considered alone or in combination, describe nor suggest an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus includes at least two phase-locking satellite receivers configured to reference signals received from a set of satellites, and a processor configured to determine a set of phase differences between the reference signals received by the satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive. Specifically, neither Lightsey nor BeVan, considered alone or in combination, describe nor suggest a processor configured to determine an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, BeVan describes determining aircraft heading from a conventional compass system. For at least the reasons set forth above, Claim 15 is submitted to be patentable over Lightsey in view of BeVan.

Claim 18 depends, indirectly, from independent Claim 15. When the recitations of Claim 18 are considered in combination with the recitations of Claim 15, Applicants submit that Claim 18 likewise is patentable over Lightsey in view of BeVan.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 4 and 18 be withdrawn.

The rejection of Claims 5-9, 12-14, 19-23, 28 and 29 under 35 U.S.C. § 103(a) as being unpatentable over Lightsey in view of U.S. Patent No. 6,218,961 (Gross et al.) is respectfully traversed.

Lightsey is described above. Gross et al. describe a location determination system (LDS) for determining a location of railway vehicles without using a network of trackside indicators. The LDS includes a Kalman filter 500, a track database 550, a turn out processor 540, and four different sensors, which may include a GPS 510, a tachometer 520, a gyro 530, and an accelerometer 560. Turn out processor 540 identifies on which of several possible track paths a vehicle may be traveling by combining sensors 510, 520, 530 and 560 with track database 550. Track database 550 may include data representing the identification of the track, the location of the track segments, the curvature of the track segments, the grade of the track, control points, and switch locations. Track heading is computed from the curvature and/or grade data points and stored in track database 550. Vehicle heading is determined from gyro 530. The LDS computes a heading error by subtracting the track heading, stored in database 550, from the vehicle heading obtained from gyro 530 to determine on which path the vehicle is traveling.

Applicants respectfully submit that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Lightsey with Gross et al., because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicants' own teaching. Rather, only the conclusory statement that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the curvature finding methods of Gross et al. in the invention of Lightsey because such modification would allow the use of both satellite signals and inertial sensors to both measure the same values and act as a redundant systems, or to use both systems to improve accuracy of both measurements" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Since there is no teaching nor suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection be withdrawn.

Further, and to the extent understood, neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest the claimed combination, and as such, the presently pending claims are patentably distinguishable from the cited combination. More specifically, Claims 5-9 and 12-14 depend, directly or indirectly, from independent Claim 1, which recites a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises "providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive...determining a set of phase differences between satellite reference signals received by satellite receivers ... determining an accurate heading of the locomotive using the set of phase differences between

the satellite reference signals, wherein the heading represents the direction of travel of the locomotive.”

Neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method includes providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive, determining a set of phase differences between satellite reference signals received by satellite receivers, and determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive. More specifically, neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest determining an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, Gross et al. describe a method for determining the location of railway vehicles, wherein a location determination system (LDS) determines the heading of a vehicle using a gyro, track curvature data and track grade data. For at least the reasons set forth above, Claim 1 is submitted to be patentable over Lightsey in view of Gross et al.

Claims 5-9 and 12-14 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 5-9 and 12-14 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 5-9 and 12-14 likewise are patentable over Lightsey in view of Gross et al.

Claims 19-23, 28 and 29 depend, directly or indirectly, from independent Claim 15, which recites an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises “at least two phase-locking satellite receivers configured to reference signals received from a set of satellites...a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the

locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive.”

Neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus includes at least two phase-locking satellite receivers configured to reference signals received from a set of satellites, and a processor configured to determine a set of phase differences between the reference signals received by the satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive. Specifically, neither Lightsey nor Gross et al., considered alone or in combination, describe or suggest a processor configured to determine an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, Gross et al. describe a location determination system (LDS) for determining the location of railway vehicles, wherein the LDS determines the heading of a vehicle using a gyro, track curvature data and track grade data stored in a track database. For at least the reasons set forth above, Claim 15 is submitted to be patentable over Lightsey in view of Gross et al.

Claims 19-23, 28 and 29 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 19-23, 28 and 29 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 19-23, 28 and 29 likewise are patentable over Lightsey in view of Gross et al.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 5-9, 12-14, 19-23, 28, and 29 be withdrawn.

The rejection of Claims 10, 11 and 24-27 under 35 U.S.C. § 103(a) as being unpatentable over Lightsey in view of Gross et al., and further in view of U.S. Patent No. 5,896,947 (Kumar) is respectfully traversed.

Lightsey is described above. Gross et al. are described above. Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's 1 tractive wheels and lubricating the top of the rail (TOR) behind the tractive wheels to reduce the resistance of the trailing cars and reduce the locomotive wheel flange wear. The method includes controlling both lubricating units with the same computer controller 2 when a single locomotive 1 is used and two controllers 2F, 2R located in two different locomotives 1 in the case of a train consist 10.

Applicants respectfully submit that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Lightsey, Gross et al., or Kumar, considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Lightsey with Gross et al. and Kumar, because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicants' own teaching. Rather, only the conclusory statement that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the invention of Kumar with Lightsey and Gross et al. because such modification would make a track lubrication system that measures track curvature better which would make distributing the correct amount of lubricant easier" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is

rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Since there is no teaching nor suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection be withdrawn.

Further, and to the extent understood, none of Lightsey, Gross et al., or Kumar, considered alone or in combination, describe or suggest the claimed combination, and as such, the presently pending claims are patentably distinguishable from the cited combination. More specifically, Claims 10 and 11 depend, directly or indirectly, from independent Claim 1, which recites a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method comprises “providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive...determining a set of phase differences between satellite reference signals received by satellite receivers...determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive.”

None of Lightsey, Gross et al., nor Kumar, considered alone or in combination, describe or suggest a method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, wherein the method includes providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive, determining a set of phase differences between satellite reference signals received by satellite receivers, and determining an accurate heading of the locomotive using a set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive. More specifically, none of Lightsey, Gross et al., nor Kumar, considered alone

or in combination, describe or suggest a determining an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, Gross et al. describe a method for determining the location of railway vehicles, wherein a location determination system (LDS) determines the heading of a vehicle using a gyro, track curvature data and track grade data, and Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's tractive wheels and lubricating the top of the rail (TOR) behind the locomotive's tractive wheels. For at least the reasons set forth above, Claim 1 is submitted to be patentable over Lightsey in view of Gross et al., and further in view of Kumar.

Claims 10 and 11 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 10 and 11 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 10 and 11 likewise are patentable over Lightsey in view of Gross et al., and further in view of Kumar.

Claims 24-27 depend, directly or indirectly, from independent Claim 15, which recites an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus comprises "at least two phase-locking satellite receivers configured to reference signals received from a set of satellites...a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive."

None of Lightsey, Gross et al., nor Kumar, considered alone or in combination, describe or suggest an apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of the locomotive in the lead in the direction of travel of the locomotive, wherein the apparatus includes at least two phase-locking satellite receivers configured to reference signals received from a set of satellites, and a processor configured to determine a set of phase differences between the reference signals received by the satellite receivers and an accurate heading of


the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive. More specifically, none of Lightsey, Gross et al., nor Kumar, considered alone or in combination, describe or suggest a processor configured to determine an accurate heading of a locomotive using a set of phase differences between satellite reference signals, wherein the heading represents the direction of travel of the locomotive. Rather, Lightsey describes a method for vehicle roll, pitch, and azimuth attitude determination, but does not describe nor suggest determining an accurate heading of the vehicle that represents the direction of travel of the vehicle. Furthermore, Gross et al. describe a location determination system (LDS) for determining the location of railway vehicles, wherein the LDS determines the heading of a vehicle using a gyro, track curvature data and track grade data, and Kumar describes a method for simultaneously lubricating the rail gage side (RAGS) and wheel flanges ahead of a locomotive's tractive wheels and lubricating the top of the rail (TOR) behind the tractive wheels. For at least the reasons set forth above, Claim 15 is submitted to be patentable over Lightsey in view of Gross et al., and further in view of Kumar.

Claims 24-27 depend, directly or indirectly, from independent Claim 15. When the recitations of Claims 24-27 are considered in combination with the recitations of Claim 15, Applicants submit that Claims 24-27 likewise are patentable over Lightsey in view of Gross et al., and further in view of Kumar.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 10, 11 and 24-27 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,


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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Zahm et al. :
Serial No.: 09/585,192 : Art Unit: 3661
Filed: June 1, 2000 : Examiner: B. Broadhead
For: METHODS AND APPARATUS FOR MEASURING :
NAVIGATIONAL PARAMETERS OF A LOCOMOTIVE :

SUBMISSION OF MARKED UP CLAIMS

Assistant Commissioner for Patents
Box NON-FEE AMENDMENT
Washington, D.C. 20231

Sir:

Submitted herewith are marked up claims in accordance with 37 C.F.R.
1.121(c)(1)(ii).

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IN THE CLAIMS

1. (twice amended) A method for determining at least one of motion and location parameters of a locomotive, with either end thereof in the lead in the direction of travel of the locomotive, said method comprising the steps of:

providing at least two satellite signal receivers on the locomotive at spaced locations along the length of the locomotive;

determining a set of phase differences between satellite reference signals received by satellite receivers; and

determining an accurate heading of the locomotive using the set of phase differences between the satellite reference signals, wherein the heading represents the direction of travel of the locomotive.

15. (twice amended) An apparatus for determining at least one of motion and location parameters of a locomotive to detect curves and reduce track wear, with either end of

the locomotive in the lead in the direction of travel of the locomotive, said apparatus comprising:

at least two phase-locking satellite receivers configured to reference signals received from a set of satellites; and

a processor configured to determine a set of phase differences between the reference signals received by said satellite receivers and an accurate heading of the locomotive using the set of phase differences between the reference signals, wherein the heading represents the direction of travel of the locomotive.

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